

REMARKS

Claim Rejections - 35 USC § 103

In the Office Action, the Examiner rejected claims 1 to 16 under 35 U.S.C. 103(a) as being unpatentable over Dietle et al. '514 (previously cited) in view of applicant's admission of prior art at page 2, lines 5-7. The Examiner argued that it would have been obvious to one of ordinary skill in the art "to provide O-rings taught by applicant's admission of prior art, since doing so provides a seal for use with a rotary shaft".

Response to Arguments

Independent claims 1 and 10 have been amended to recite the limitation that the shaft has a surface speed higher than 200 ft/min. These features were originally recited in claims 9 and 15, both of which have been cancelled.

For the following reasons, it is respectfully submitted that the invention as now claimed is not obvious. First, it would not in fact have been obvious to provide O-rings in place of the rotary seals disclosed by Dietle et al. considering the teaching of the admitted prior art. Second, the hypothetical combination of that art and Dietle, if attempted, would not result in applicant's invention as claimed. The art (discussed at page 2, lines 5-7) is Brown - "Seals and Sealing Handbook", a copy of which was provided with applicant's Information Disclosure Statement of November 25, 2003.

In broad terms, applicant's invention can be characterized as the recognition that a superior seal can be achieved by providing an annular chamber between a pair of O-rings and circulating through the chamber a cooling fluid, while pressurizing the fluid within the chamber to cause the O-rings to deform and seal

against the rotary shaft. The seal is superior in that it can operate for extended periods of time at high shaft surface speeds typically encountered in centrifugal pumps.

Applicant's claims bring out these features. The claims refer specifically to a cooling fluid that is circulated through the annular chamber between the O-rings and to the provision of means for creating a positive cooling fluid pressure within the annular chamber. Even if Dietle et al. disclosed O-ring seals (which it does not) Dietle does not disclose the use of cooling fluid circulated under pressure through an annular chamber between the seals as claimed.

It is admitted that the Brown reference discloses the use of O-rings as rotary seals. However, Brown makes it clear that O-rings have only a limited application as rotary seals. On page 215, the reader is cautioned that surface speeds should preferably be below 200 ft/min.

The Examiner 's position is that it would be obvious in view of Brown to use O-ring seals in the cartridge of Dietle et al. With respect, this argument is disputed. Brown makes it clear that O-rings have only very limited application as rotary seals, and suggests that they should not be used at surface speeds higher than about 200 ft/min. Surprisingly, and contrary to the teachings of the prior art, the present inventor has found that O-ring seals in fact provide superior performance in terms of long life at much higher surface speeds than those envisaged by Brown, if a cooling fluid is circulated through the chamber between the seals and is pressurized to cause the O-rings to deform into sealing contact with the shaft.

It is well accepted that, when considering obviousness, it is not permissible to use the benefit of hindsight. Rather, the question is whether the invention would have been obvious to a person skilled in the art on the relevant date. In the present case, it is submitted that the notional person skilled in the art of rotary seals for the drive shafts of centrifugal pumps seeking to design a superior seal would reject

O-rings on the basis that they would be unsatisfactory for the severe service conditions that are encountered in such pumps. Even if the notional skilled person had been made aware of Brown, the warnings in Brown that O-rings have only limited application as rotary seals and may fail at speeds above 200 ft/min, would have made that person reject the idea of using O-ring seals for a centrifugal pump drive shaft.

In summary, a skilled person considering the use of O-ring seals as rotary seals would reject them for high speed applications, given the warnings in Brown. The present inventor realized that pressuring the fluid could be used to deflect O-rings. That is not taught by Dietle or any other of the prior art. Likewise, there is no teaching that seal life can be increased by using the pressurized fluid for cooling.

Favourable reconsideration is respectfully requested.

Respectfully submitted,
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